

Claims

WHAT IS CLAIMED IS:

1. A multi-wavelength light source, comprising:
a gain medium which emits light of a plurality of wavelengths in response
5 to pumping, the gain medium disposed in an optical cavity which repetitively
passes light through the gain medium; and
an optical equalizer in the optical cavity, the optical equalizer adjusting the
optical power of at least one of the wavelengths so as to provide more even
optical power distribution among the plurality of wavelengths propagating
10 through the optical cavity.
2. The multi-wavelength light source of Claim 1, the optical equalizer
adjusting the optical power of at least 10 of the wavelengths so as to provide more even
optical power distribution among the plurality of wavelengths.
3. The multi-wavelength light source of Claim 1, the optical equalizer
15 adjusting the optical power of at least 20 of the wavelengths so as to provide more even
optical power distribution among the plurality of wavelengths.
4. The multi-wavelength light source of Claim 1, wherein the gain medium is
an indium phosphide-based semiconductor gain medium.
5. The multi-wavelength light source of Claim 1, wherein the gain medium
20 comprises an erbium-doped glass fiber.
6. The multi-wavelength light source of Claim 1, wherein the gain medium
comprises a first end and a second end, said gain medium having a reflector at the first
end, the second end of the gain medium being optically coupled to the optical equalizer.
7. The multi-wavelength light source of Claim 6, wherein the first end
25 comprises a dielectric mirror.
8. The multi-wavelength light source of Claim 1, wherein the gain medium
comprises a first end and a second end, and the optical equalizer is optically coupled to
the first end of the gain medium and the second end of the gain medium to form a ring
cavity configuration.

9. The multi-wavelength light source of Claim 1, wherein the optical equalizer is formed on a silicon-on-insulator chip.

10. The multi-wavelength light source of Claim 1, wherein the gain medium comprises a semiconductor optical amplifier, the optical equalizer is formed on a silicon-on-insulator chip, and the semiconductor optical amplifier is optically coupled to the silicon-on-insulator chip via waveguides having a coupling region comprising at least one of an antireflection coating and an angled chip interface.

11. The multi-wavelength light source of Claim 1, wherein the optical equalizer comprises:

10 a first multiplexer/demultiplexer having a first multiplexed light waveguide and a first plurality of demultiplexed light waveguides for propagating multiplexed and demultiplexed light respectively, the first multiplexed light waveguide optically coupled to the gain medium;

15 a second multiplexer/demultiplexer having a second multiplexed light waveguide and a second plurality of demultiplexed light waveguides for propagating multiplexed and demultiplexed light respectively, the second multiplexed light waveguide optically coupled to the gain medium, each of the second plurality of demultiplexed light waveguides optically coupled to a corresponding one of the first plurality of demultiplexed light waveguides;

20 a plurality of attenuators, wherein each attenuator is optically coupled to a corresponding one of the first plurality of demultiplexed light waveguides and to a corresponding one of the second plurality of demultiplexed light waveguides; and

25 a plurality of phase shifters, wherein each phase shifter is optically coupled to a corresponding one of the first plurality of demultiplexed light waveguides and to a corresponding one of the second plurality of demultiplexed light waveguides in series with a corresponding one of the plurality of attenuators.

12. The multi-wavelength light source of Claim 11, wherein the first multiplexer/demultiplexer is an arrayed waveguide grating and the second multiplexer/demultiplexer is an arrayed waveguide grating.

13. The multi-wavelength light source of Claim 1, wherein the optical cavity comprises:

a Y-junction optically coupled to the gain medium;

a first waveguide optically coupled to the gain medium via the Y-junction;

5 a second waveguide optically coupled to the gain medium via the Y-junction; and

a plurality of filter elements optically coupled in parallel between the first waveguide and the second waveguide, wherein each filter element transmits a different wavelength between the first waveguide and the second waveguide.

10 14. The multi-wavelength light source of Claim 13, wherein light from the gain medium is split substantially equally between the first waveguide and the second waveguide by the Y-junction.

15 15. The multi-wavelength light source of Claim 13, wherein each filter element comprises a ring resonator.

16. The multi-wavelength light source of Claim 13, wherein the optical equalizer further comprises a plurality of phase shifters, wherein each filter element is optically coupled to a corresponding one of the plurality of phase shifters.

17. The multi-wavelength light source of Claim 13, wherein the optical equalizer comprises a plurality of optical attenuators, wherein each filter element is optically coupled to a corresponding one of the plurality of optical attenuators.

18. The multi-wavelength light source of Claim 1, wherein the optical cavity comprises a plurality of filter elements optically coupled in parallel to the gain medium, wherein each filter element transmits a different set of wavelengths.

19. The multi-wavelength light source of Claim 18, wherein the optical equalizer comprises a plurality of optical attenuators, wherein each filter element is optically coupled to a corresponding one of the plurality of optical attenuators.

20. The multi-wavelength light source of Claim 18, wherein the optical equalizer comprises a plurality of phase shifters, wherein each filter element is optically coupled to a corresponding one of the plurality of phase shifters.

21. The multi-wavelength light source of Claim 1, further comprising an optical power monitor optically coupled to the optical equalizer, wherein the optical power monitor responds to a measured optical power distribution by transmitting a feedback signal to the optical equalizer.

5 22. The multi-wavelength light source of Claim 18, wherein the optical power monitor is optically coupled to the optical equalizer via a plurality of taps, wherein respective taps are optically coupled to optical paths through said plurality of filter elements, respectively.

23. The multi-wavelength light source of Claim 18, wherein the optical power
10 monitor is optically coupled to the optical equalizer via a single tap and a demultiplexer, wherein the tap transmits light from the optical cavity to the demultiplexer and the demultiplexer separates the light into a plurality of channel corresponding to the plurality of wavelengths.

24. A method of producing a plurality of optical outputs at different
15 wavelengths, the method comprising:

pumping a laser gain medium to generate light having a plurality of different wavelengths;

resonating the light of the plurality of different wavelengths in an optical cavity;

20 providing a more even distribution of optical power among the plurality of different wavelengths resonating in the optical cavity by adjusting the optical power of at least one of the wavelengths; and

coupling a fraction of the light propagating through the optical cavity out of the optical cavity.

25 25. A method of producing optical signals for optical communications, the method comprising:

generating laser light through at least a substantial portion of the gain bandwidth of a laser medium disposed in a resonant cavity;

outputting the laser light from the laser medium as a gain medium signal;
and

5 simultaneously generating plural discrete communication signals from the
laser light by repetitively modifying the optical power distribution of the gain
medium signal and repetitively feeding the modified gain medium signal back to
the laser medium.

26. The method of Claim 25, further comprising separately modulating each of
the discrete communication signals to encode information thereon.

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